# NOTES 19: CLT-BASED INFERENCE FOR PROPORTIONS

Stat 120 | Fall 2025
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**CLT:** The Central Limit Theorem (CLT) tells us that if the sample size is big enough and the sample is random,

$$\bar{X} \sim N(\underline{\quad\quad}, \underline{\quad\quad})$$

$$\hat{p} \sim N(\underline{\quad\quad}, \underline{\quad\quad})$$

The general form for a **confidence interval** is:

**Example:** Finding $z^*$

- 95% confidence interval
- 68% confidence interval
- 99% confidence interval
- 90% confidence interval

## 1 How big is big enough?

**Example 1:** $\hat{p} = .5$

**Example 1:** $\hat{p} = .05$

> **Rule of Thumb for Proportions**:
>
> - Expected count in each category (Yes/No) should be > ____
> - $np > $ ____ and $n(1-p) > $ ____

## 2 How do we find the SE?

> **Standard Error for Proportions**:
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>
>
>
>
>

**Idea:** As $n$ gets bigger, the SE gets _____. If $\hat{p}$ is close to .5, the SE is _____ than if $\hat{p}$ is close to 0 or 1

**Example:** ESP Example Again

n = 14

```r
p_hat = 3/14
n = 14
SE_p = sqrt((p_hat*(1-p_hat))/n)
z_score = (p_hat - .2)/SE_p
p_val = pnorm(z_score, lower.tail = FALSE)
p_val
```

```
[1] 0.4482
```

n=1400:

n=14000:

**Big Picture** Picture